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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/599,367	06/21/2000	Satoru Furuta	193176US2	6885

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EXAMINER	
MICHALSKI, JUSTIN I	
ART UNIT	PAPER NUMBER
2644	

DATE MAILED: 09/21/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/599,367	Applicant(s) FURUTA, SATORU	
	Examiner Justin Michalski	Art Unit 2644	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 July 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11* is/are rejected.

7)☒ Claim(s) *12-17* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 22 July 2005 has been entered.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1, 2, 10, and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Crozier et al. (Hereinafter "Crozier") (US Patent 5,742,927) in view of Katayanagi et al. (Hereinafter "Katayanagi") (US Patent 5,687,285).

Regarding Clam 1, Crozier discloses a noise suppression apparatus (Figure 4), which can remove an inutile noise from an input signal comprising an object signal and the inutile noise mixed therein to output the object signal (Crozier discloses noise reduction and noise over a speech signal, i.e. object signal) (Column 1, lines 9-12), said apparatus comprising; a time/frequency conversion unit which converts the input signal

into an amplitude spectrum and phase spectrum by frequency-analyzing the input signal in each frame (FFT, reference 3); a noise-likeness analyzing unit which receives the input signal including the object signal and the noise mix therein and determines the noise-likeness of the input signal frame references 5 and 6); a noise amplitude spectrum calculation unit which calculates the noise amplitude spectrum from the input amplitude spectrum of the frame on the basis of the result of said noise-likeness analyzing unit (reference 6); a spectrum correction gain calculation unit (references 8, 7', 8', 9', 10', 21, and 22)) which calculates a noise amplitude spectrum correction gain (output of reference 8), on the basis of the input amplitude spectrum (input signal 1), the noise amplitude spectrum (output of reference 6) and a first predetermined coefficient ($\alpha 1$), and which calculates a noise removal spectrum correction gain (output of reference 22), on the basis of the input amplitude spectrum (signal 1), the noise amplitude spectrum (output of reference 6) and a second predetermined coefficient (α_2); a spectrum deduction unit (reference 7) which calculates a product of the noise amplitude spectrum (input from reference 4) and the noise amplitude spectrum correction gain (signal from reference 8 to reference 7), which is sent from said spectrum correction gain calculation unit (8), then deducts the product from the input amplitude spectrum so as to output a first noise removal spectrum (output of reference 7); a spectrum suppression unit (reference 20) which calculates a product of the first noise removal spectrum (output of 7) and the noise removal spectrum correction gain (output of 22) so as to output a second noise removal spectrum (output of 20 to 10); and

a frequency/time conversion unit (inverse FFT 10) which converts the second noise removal spectrum to a time domain signal.

Crozier does not disclose the noise-likeness analyzing unit performing linear predictive analysis to obtain coefficients to generate a low pass residual signal, and which performs correlation analysis on the low pass residual signal. Katayanagi also discloses a noise reduction method including linear predictive analysis to obtain linear predictive coefficients used to generate a low pass residual signal and correction analysis (Col. 8, lines 5-21; Fig. 4, references 2-5). Katayanagi discloses the linear prediction coefficient is used to detect the background noise of the audio signal (Col. 7, lines 62-66). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use linear predictive analysis to help detect and remove background noise as taught by Katayanagi.

Regarding Claim 2, Crozier further discloses said spectrum correction gain calculation unit comprises, a spectrum correction gain limiting value calculation unit (22) which calculates spectrum correction gain limiting values (Crozier discloses correction limit of 0 as disclosed in Figure 3 and equation on Column 4, line 31 when $H(\omega)=1$), on the basis of the input amplitude spectrum (signal input 1) and the noise amplitude spectrum (output of reference 6), which spectrum correction gain limiting values limit the correction gains of the noise amplitude spectrum (signal from 8 to 7 limited at reference 20) and the noise removal spectrum (output of reference 22); and a correction gain calculation unit (22) which calculates a noise amplitude spectrum correction gain and a

noise removal spectrum correction gain (signal from 22 to 20), on the basis of the input amplitude spectrum (input 1), the noise amplitude spectrum (output of 6) and the spectrum correction gain limiting value (Column 4, lines 31-39; and figure 3), which noise amplitude spectrum correction gain corrects the value of the amplitude of the noise amplitude spectrum (output of 6 corrected at reference 20) in each frequency component (figure 3 discloses reference 20 as a function of ω, i.e. frequency), and which noise removal spectrum correction gain corrects the value of the amplitude of the noise removal spectrum for each frequency component (Figure 6 discloses correction of noise removal spectrum at reference 20 as a function of ω, i.e. frequency).

Regarding Claim 10, Crozier discloses a noise suppression apparatus (Figure 4), comprising: a unit for determining noise amplitude spectrum of an input signal from noise-likeness of the input signal (references 5 and 6) and determines the noise-likeness on the input signal, the input signal including a noise component (input 1); a unit for calculating a noise amplitude spectrum gain based on an input amplitude spectrum of the input signal and the noise amplitude spectrum (reference 6), correcting the noise amplitude spectrum gain with a predetermined first coefficient (α_1) to obtain a noise amplitude spectrum correction gain (signal from reference 8 to reference 7), and calculating a noise removal spectrum correction gain (signal from reference 8 to reference 7) based on the input amplitude spectrum of the input signal (input 1) and the noise amplitude spectrum (signal from 6 to 7); and a unit for performing (unit 7), with respect to the input amplitude spectrum of the input signal (input 1), spectrum

subtraction based on the noise amplitude spectrum correction gain (signal from reference 8 to reference 7) and spectrum suppression based on the noise removal spectrum correction gain (signal from reference 8 to reference 7) to thereby remove the noise component from the input signal (Crozier discloses noise reduction, i.e. removal of noise component; Column 1, lines 9-12).

Crozier does not disclose the noise-likeness analyzing unit performing linear predictive analysis to obtain coefficients to generate a low pass residual signal, and which performs correlation analysis on the low pass residual signal. Katayanagi also discloses a noise reduction method including linear predictive analysis to obtain linear predictive coefficients used to generate a low pass residual signal and correction analysis (Col. 8, lines 5-21; Fig. 4, references 2-5). Katayanagi discloses the linear prediction coefficient is used to detect the background noise of the audio signal (Col. 7, lines 62-66). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use linear predictive analysis to help detect and remove background noise as taught by Katayanagi.

Regarding Claim 11, Crozier discloses a noise suppression apparatus (Figure 4), comprising: a unit for determining noise amplitude spectrum on an input signal from noise-likeness of the input signal (references 5 and 6), the input signal including a noise component (input 1); a unit for calculating a noise amplitude spectrum gain (output of reference 6) based on an input amplitude spectrum of the input signal and the noise amplitude spectrum (reference 6) which determines the noise-likeness of the input

signal, calculating a noise removal spectrum correction gain (signal from reference 6 to reference 8 and 8') based on the input amplitude spectrum of the input signal (input 1) and the noise amplitude spectrum (reference 6), and correcting the noise removal spectrum correction gain using a predetermined second coefficient (α_2) to obtain a noise removed spectrum correction gain (signal from 8' to 7'); a unit for performing, with respect to the input amplitude spectrum of the input signal (input 1), spectrum subtraction based on the noise amplitude spectrum gain and spectrum suppression based on the noise removal spectrum correction gain to thereby remove the noise component from the input signal (spectrum subtractor 7').

Crozier does not disclose the noise-likeness analyzing unit performing linear predictive analysis to obtain coefficients to generate a low pass residual signal, and which performs correlation analysis on the low pass residual signal. Katayanagi also discloses a noise reduction method including linear predictive analysis to obtain linear predictive coefficients used to generate a low pass residual signal and correction analysis (Col. 8, lines 5-21; Fig. 4, references 2-5). Katayanagi discloses the linear prediction coefficient is used to detect the background noise of the audio signal (Col. 7, lines 62-66). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use linear predictive analysis to help detect and remove background noise as taught by Katayanagi.

4. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Crozier/Katayanagi as applied to claim 2 in view of Lockwood et al. (Hereinafter

"Lockwood") (US Patent 6,477,489). Crozier/Katayanagi discloses a apparatus as stated apropos of claim 2 above further disclosing smoothing a frequency spectrum by taking the average of several surrounding samples and averages when speech in not present, i.e. noise spectrum (Column 3, lines 15-19). Crozier does not disclose taking the average of each frequency band and using them in place of the input amplitude spectrum and the noise amplitude spectrum. Lockwood discloses a method and apparatus for suppressing noise in a digital signal (Figure 1) including a spectrum band dividing unit (12) which divides the input amplitude spectrum sent from a time/frequency conversion unit into a plurality of frequency bands and calculates the average spectrum of each frequency band, and divides the noise amplitude spectrum. Lockwood discloses taking the average of the spectral components of the signal in bands (Paragraph bridging columns 3 and 4). Lockwood teaches that this averaging reduces fluctuations between bands by averaging the contributions of the noise in the bands, which reduces the variance of the noise estimator. Lockwood also states averaging greatly reduces the complexity of the system (Column 4, lines 11-15). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to take the average of each frequency band in order to reduce fluctuations between bands and reduce the variance of the noise estimator as taught by Lockwood.

5. Claims 4 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Crozier/Katayanagi as applied to claim 1 above in view of Chan et al. (Hereinafter "Chan") (US Patent 5,668,927).

Regarding Claim 4, Crozier/Katayanagi discloses an apparatus as stated apropos of claim 1 above including smoothing the spectrum of the input signal (i.e. spectrum smoothing coefficient unit) when speech is not present (Column 3, lines 10-17). Crozier further discloses the spectrum correcting gain calculation unit comprises a correction gain calculation unit (references 7, 8, 7', 8', 9', 10', 21, and 22) which calculates a noise amplitude spectrum correction gain (output of 22) and a noise removal spectrum correction gain (signal from 8 to 7), on the basis of the smoothed input amplitude spectrum and the smoothed noise amplitude spectrum (output of 6), correcting the value of the amplitude for each frequency component of the noise amplitude spectrum (subtractor 7), and which noise removal spectrum correction gain is used for correcting the value of the amplitude of the noise removal spectrum (reference 20). Crozier does not disclose smoothing the spectrum in the time and frequency base. Chan discloses an apparatus for reducing noise in a signal by spectral subtraction (Figure 1) including a soft discrimination suppression unit 20 (i.e. spectrum smoothing unit) which filters the signal along the frequency and time axis (Column 10, lines 47-50). Chan further discloses the smoothed signal used for spectrum correction at unit 23. Chan teaches that smoothing in the frequency and time axis has the effect of eliminating any circular convolution aliasing effects and limiting the rate of change of the filter in suppressing noise bursts Column 3, lines 47-56). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to smooth the signal in time and frequency base to eliminate any circular convolution aliasing

effects and limit the rate of change of the filter in suppressing noise bursts as taught by Chan.

Regarding Claim 8, Crozier further discloses the spectrum smoothing takes place at noise store 6 which is based on the signal from detector 5 (i.e. noise likeness analyzing unit) (Col. 3, lines 8-20).

6. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Crozier as modified as applied to claim 4 above, and further in view of Lockwood et al. (US Patent 6,477,489).

Regarding Claim 5, Crozier further discloses a spectrum smoothing coefficient calculation unit (Column 3, lines 12-21) which calculates smoothing coefficients for the input amplitude spectrum and the noise amplitude spectrum (Crozier discloses averaging signal of $P_y(\omega)$, i.e. signal containing noise and input amplitude (Column 3, line 17), on the basis of the input amplitude average spectrum and the noise amplitude average spectrum from the time/frequency conversion unit (FFT 3). Crozier further discloses a spectrum smoothing unit (reference 5 and 6) which calculates a smoothed spectrum based on averaging (Col. 3 lines 15-17). Crozier as modified does not disclose a spectrum band dividing unit which divides the input amplitude spectrum into a plurality of frequency bands and calculate the average of each band. Lockwood discloses a method and apparatus for suppressing noise in a digital signal (Figure 1) including a spectrum band dividing unit (12) which divides the input amplitude spectrum sent from a time/frequency conversion unit into a plurality of frequency bands and

calculates the average spectrum of each frequency band, and divides the noise amplitude spectrum. Lockwood discloses taking the average of the spectral components of the signal in bands (Paragraph bridging columns 3 and 4). Lockwood teaches that this averaging reduces fluctuations between bands by averaging the contributions of the noise in the bands, which reduces the variance of the noise estimator. Lockwood also states averaging greatly reduces the complexity of the system (Column 4, lines 11-15). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to take the average of each frequency band in order to reduce fluctuations between bands and reduce the variance of the noise estimator as taught by Lockwood.

7. Claims 6 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Crozier/Katayanagi as applied to claim 2 above in view of Chan et al. (Hereinafter "Chan") (US Patent 5,668,927).

Regarding Claim 6, Crozier/Katayanagi discloses an apparatus as stated apropos of claim 2 above including smoothing the spectrum of the input signal (i.e. spectrum smoothing coefficient unit) when speech is not present (Column 3, lines 10-17). Crozier further discloses the spectrum correcting gain calculation unit comprises a correction gain calculation unit (references 7, 8, 7', 8', 9', 10', 21, and 22) which calculates a noise amplitude spectrum correction gain (output of 22) and a noise removal spectrum correction gain (signal from 8 to 7), on the basis of the smoothed input amplitude and the noise amplitude spectrum (output of 6) and the spectrum

correction gain limiting value (Crozier discloses correction limit of 0 as disclosed in Figure 3 and equation on Column 4, line 31 when $H(\omega)=1$). Crozier does not disclose smoothing the spectrum in the time and frequency base. Chan discloses an apparatus for reducing noise in a signal by spectral subtraction (Figure 1) including a soft discrimination suppression unit 20 (i.e. spectrum smoothing unit) which filters the signal along the frequency and time axis (Column 10, lines 47-50). Chan further discloses the smoothed signal used for spectrum correction at unit 23. Chan teaches that smoothing in the frequency and time axis has the effect of eliminating any circular convolution aliasing effects and limiting the rate of change of the filter in suppressing noise bursts Column 3, lines 47-56). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to smooth the signal in time and frequency base to eliminate any circular convolution aliasing effects and limit the rate of change of the filter in suppressing noise bursts as taught by Chan.

Regarding Claim 9, Crozier further discloses the spectrum smoothing takes place at noise store 6 which is based on the signal from detector 5 (i.e. noise likeness analyzing unit) (Col. 3, lines 8-20).

8. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Crozier as modified as applied to claim 6 above, and further in view of Lockwood et al. (US Patent 6,477,489).

Crozier as modified further discloses said signal spectrum smoothing coefficient calculation unit (Crozier, references 5 and 6), said spectrum smoothing unit (reference

6), and said spectrum correction gain limiting value calculation unit (equation on Column 4, lines 31-39) and said correction gain calculation unit use the output from reference 5 which calculates the average of the signal spectrum. Crozier does not disclose a spectrum band dividing unit to average of each frequency band. Lockwood discloses a method and apparatus for suppressing noise in a digital signal (Figure 1) including a spectrum band dividing unit (12) which divides the input amplitude spectrum sent from a time/frequency conversion unit into a plurality of frequency bands and calculates the average spectrum of each frequency band, and divides the noise amplitude spectrum. Lockwood discloses taking the average of the spectral components of the signal in bands (Paragraph bridging columns 3 and 4). Lockwood teaches that this averaging reduces fluctuations between bands by averaging the contributions of the noise in the bands, which reduces the variance of the noise estimator. Lockwood also states averaging greatly reduces the complexity of the system (Column 4, lines 11-15). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to take the average of each frequency band in order to reduce fluctuations between bands and reduce the variance of the noise estimator as taught by Lockwood.

Allowable Subject Matter

9. Claims 12-17 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Justin Michalski whose telephone number is (571)272-7524. The examiner can normally be reached on M-F 7-3:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vivian Chin can be reached on (571)272-7848. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

JIM
September 16, 2005

VIVIAN CHIN
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